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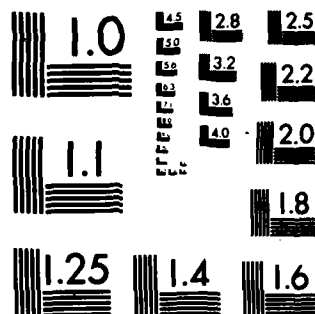
USERSIN - AN INTERACTIVE USER-INTERFACE FOR FORTRAN SIN 1/1
(U) MATERIALS RESEARCH LABS ASCOT VALE (AUSTRALIA)
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DEPARTMENT OF DEFENCE
DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION
MATERIALS RESEARCH LABORATORIES
MELBOURNE, VICTORIA

REPORT

MRL-R-877

USERSIN - AN INTERACTIVE USER-INTERFACE FOR FORTRAN SIN

E. Northeast

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ABSTRACT

This report describes a program Usersin, written to give a quick and ready access to the necessary input data, and to provide a more convenient interactive mode for setting up a problem while the "number-crunching" remains a batch-oriented process. It is designed to be as machine independent as possible, to permit transition between computers as may be required.

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USERSIN - AN INTERACTIVE USER-INTERFACE FOR

FORTRAN SIN

1. INTRODUCTION

An increasing requirement for hydrodynamic calculations to predict explosive behaviour and weapon performance has arisen from the complexity and expense of detailed experimentation in these fields. Many explosive and weapon systems can be simulated by relatively simple one-dimensional computer codes. Phenomena such as explosive-metal interactions, fragmentation and shock studies are ideally suited to this approach.

For some years, MRL has had access to SIN⁽¹⁾, a Lagrangian one-dimensional hydrodynamic program, used extensively overseas for problems including chemical reactions, material failure and phase transitions. Fortran SIN was developed at the Los Alamos Scientific Laboratories in 1964 for a CDC6600 computer and has been modified to run on the CSIRO computer network which is based on a Cyber 7600.

Running the SIN code⁽¹⁾ directly on the Cyber 76 clearly demonstrated the inherent difficulties in compiling the input data for a batch run. This Report then describes USERSIN (Fig. 1), a program developed to create interactively the input data deck for SIN.

2. SIN:

The SIN code requires a large amount of input data defining material properties, the number of cells over which the calculations are to be made, as well as the time increment to be considered. Further input data include the parameters for elastic-plastic calculations on the solids and those parameters defining the equation of state of the detonation products, the latter constants being evaluated by the BKW code⁽³⁾. (Appendix 1 lists the input data required for SIN).

As it is necessary to collect and format correctly all the data before SIN can be run, such a procedure is both a time-consuming and error-prone operation.

3. USERSIN:

The user interface usersin written in extended Fortran 4 IV. Usersin takes advantage of the computer's connected input/output subsystem (CIO) to create interactively the data deck for subsequent use by SIN.

The program is menu driven. This means that it displays a table of options, to which a user is able to select any option by entering the corresponding key. The user moves from one menu to the next being promoted with a suitable message to enter the required data. These data are then validated and written into the data deck. The program also assumes default values which may be changed by the user.

The equation of state parameters and other physical material constants are stored in a data base file. This file is a sequential file with the name of the material its key (i.e. TNT). The file is automatically searched after the components name is entered. If the component is on file, the appropriate parameters are retrieved and placed into the data deck, otherwise the user is solicited for these parameters.

Users of this program are requested to store the components they use into this data base file when prompted, thus increasing the usefulness of this data base to future users.

The Usersin package is simple to master, making SIN a more reliable and efficient research tool.

A typical run of Usersin for an expanding steel casing is shown in Appendix 3.

4. MAINTENANCE

For ease of maintaining USERSIN the program has been fully commented, each subroutine having one particular function which is explained in detail at the routines beginning. The program was written to be as machine independent as possible and a comment appears where it was not possible. The input/output variable names have been kept the same as those used in SIN so the maintenance programmer can easily swap from one to the other.

The data base file is under the format of

(1HZ, 2A6, 2X 15,/, 2(1X, E18.11), /, 9(4(1X, E18.11)/)

KEY:-	NAME	2A6
	EXPLOSIVE OR SOLID (1 OR 0)	15
	DENSITY	E18.11
	MASS FRACTION	E18.11
	C, S C1, S1, CV SPALLP, USP, SPA, F, G, H, I, J, Mo, 2/3 YO,	
	Y, MINV, VSW, PLAP, A, B, C, D, E, K, L, M, N, CV1, Q, R, S, T,	
	U, ZO, VFACT, EO, Z	E18.11

5. CONCLUSION

Development of USERSIN has been completely justified by its ease of operation, its data-storage capability and its use.

6. REFERENCES

1. Mader, C.L. and Gage, W.R. (1967).
"FORTRAN SIN", Los Alamos Scientific Laboratory Report LA-3720.
2. Mader, C.L. (1967)
"FORTRAN BKW" Los Alamos Scientific Laboratory Report LA-3704
3. Mader, C.L. (1979). Numerical Modelling of Detonations, University of California Press.

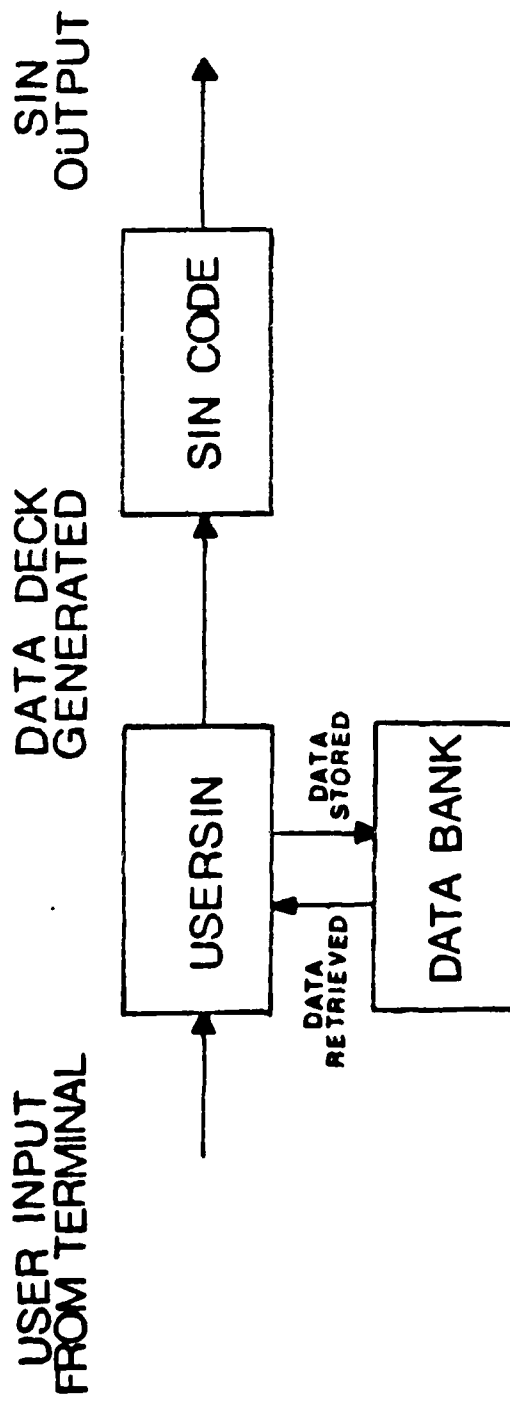


FIG. (1): USE OF SIN.

APPENDIX 1

DATA REQUIRED FOR SIN

Variable name	Default value	Units	Definitions
TITL	Time - date	-	A suitable title for the run (0-80 char)
IHC	No	-	Is a heat calculation required [Y/N]
ALPHA	SLAB		The geometry of the system SLAB - slab geometry CYL - cylindrical geometry SPHER - spherical geometry
IPINC	400	-	Every IPINC cycles are printed
IGINC	200	-	Every IGINC cycles are graphed
ILB	CON	-	Left hand boundary conditions CON - Continuum FRE - free space INIT - Initial-final piston A+BT - A + BT piston STDY - steady state reaction zone piston
IRB	CON	-	Right hand boundary conditions CON - continuum FRE - free space INIT - Initial-final piston A+BT - A + BT piston
Only required if ILB, IRB is equal to INIT "Initial-final piston"			
ALB,LRB	-	cm/ μ s	Initial piston velocity
BLB, BRB	-	cm/ μ s	final piston velocity

Variable name	Default value	Units	Definitions
------------------	------------------	-------	-------------

Only required if ILB, IRB is equal to A+BT "A + BT piston"

ALB, ARB	-	-	A
BLB, BRB	-	-	B

Only required if ILB, IRB is equal to INIT, A+BT or STDY

NLI, NRI	-	-	The number of cells initially in the calculation from the left, right if 0 all cells are taken.
NLINC, NRINC	-	-	Every NLINC, NRINC cycles a cell is added on from the left, right

The following data is required for all components

NAM	- X	-	Name of the component (0-12 char)
NINC	- X	-	Number of space increments for this component
DX	-	cm	Size of these cells
DTIME	0.2 of DX	us	Size of the time increments
IEXP	- X	-	Is the component a gas or explosive [Y/N]?
IVIS	PIC	-	PIC - Pic viscosity LAND - Landshoff form REAL - Real form
VFACT	2	-	Viscosity factor
PO	1×10^{-6}	MBAR	Initial pressure
TO	300	°K	Initial temperature
EO	0	MBar-cc/g	Initial internal energy

Variable name	Default value	Units	Definitions
U0	0	cm/ μ s	Initial velocity
RH00	0<RH00<50X	g/cm ³	Initial density
W0	0<W0<1 X		Initial mass fraction
VSW	0.01	-	-

Solid parameters

C,S	- X	-	Co-efficients to a linear set of U_s and U_p used from the initial pressure to the switch pressure.
C1,S1	- X	-	Second set of co-efficients to the linear fit of U_s and U_p used from the switch pressure to the max. pressure
CV^+	X	Cal/g/Degree	Heat of capacity of the component
V0	1/DENS	cm ³ /g	Initial volume of the condensed component
ALPH	- X	-	Linear co-efficient of thermal expansion
F,G,H,J,I,	- X	-	Constants used in the Hom condensed components equation
GAMMA	- X	-	γ -law gas constant

Not requested if the component is a gas or an explosive

SPALLP	- X	MBar	Interface spalling pressure
USP	- X	MBar	Ultimate spalling pressure
SPA	- X	-	Spalling constant to relate pressure and tension rate
SHEAR	- X	MBar	Shear modulus
Y0	- X	MBar	Yield strength

Only requested if the component is a gas or explosive

Variable name	Default value	Units	Definitions
Z	1E15 X		Frequency factor for an Arrhenius burn
E	4.5E4 X	cal/mole	Activation energy for an Arrhenius burn
VCJ	X	cm ³ /g or cm/μs	Volume of the component for a C-J burn or the C-J detonation velocity for a Gamma-Law Taylor wave.
A,B,C,D,E	- X	-	Parameters defining the equation of state of the detonation products. Parameters obtained from the BKN code ²
K,L,M,N,O	- X	-	
Q,R,S,T,U	- X	-	
Z1	- X	-	A constant used to change the standard state to be consistent with the solid explosive standard state usually ≈ 0.1
IBRN	ARR X	-	ARR - Arrhenius burn C-J - C-J volume burn GAMMA - Gamma-Law Taylor wave burn FOREST - Forest Fire burn (when available)

All variables with an "X" marked in the default value column are stored on the data base file.

APPENDIX 2

USE OF THE SIN COMPUTER CODE ON THE CYBER 7600

discussed elsewhere in this report a user interface has been developed to the data deck for the SIN code.

Compiled binary version of USERSIN are stored on the library. It is only necessary to execute this file to run USERSIN. This must be done in an interactive subsystem of the Cyber, once logged on.

quit edit subsystem
gain entry to CIO
EXECUTE (USERSIN) execute USERSIN

and a brief description of the program should then be

questions asked and at the end of the session the data cards will have been created and will only require

quit CIO subsystem
gain entry to EDIT
copy the data deck into work space
execute SIN

USERSIN is a menu driven program, for example the following initial menu. The user simply enters the

<u>MENU</u>	<u>DEFAULT</u>
enter title	Date and Time
relations	Not included
the system	SLAB
boundary conditions	CONTINUUM
boundary conditions	CONTINUUM

option at least the first three characters of the current value of the option is given on the

entered the following options are offered.

FOLLOWING:

GEOMETRY
CIRCULAR GEOMETRY
RECTANGULAR GEOMETRY

The program will validate the reply and return to the initial menu changing the default value as requested.

	<u>INITIAL MENU</u>	<u>DEFAULT</u>
<u>TITL</u>	- 80 char title	Date and Time
<u>HEAT</u>	- Heat calculation	Not included
<u>GEOM</u>	- Geometry of the system	<u>CYLINDRICAL</u>
<u>LHB</u>	- Left hand boundary conditions	CONTINUUM
<u>RHB</u>	- Right hand boundary conditions	CONTINUUM
<u>CONT</u>	- to continue	

To move to the next menu CON (continue) must be entered. The user works his way through the menu's specifying each parameter, Usersin reads and validates his reply before creating the data deck.

APPENDIX 3

System ?
: cio
Cio version 15/10/82
:submit,usersin
Enterins 7000 mode...wait

THIS IS THE FRONT END PACKAGE FOR SIN.
A ONE-DIMENSIONAL HYDRODYNAMIC CODE FOR PROBLEMS
WHICH INCLUDE CHEMICAL REACTIONS, ELASTIC-PLASTIC FLOW
,SPALLING, AND PHASE TRANSITIONS.

IT IS A QUESTION ANSWER TYPE PROGRAM, CONTROL 'H' WORKS AS BACKSPACE
IF THE WRONG DATA IS ENTERED EITHER AN ERROR MESSAGE WILL APPEAR OR YOU CAN
EDIT THE ENTERED DATA AT THE END OF EACH SECTION

ENTER ONE OF THE FOLLOWING

DEFAULT

TITLE - FOR THE TITLE OF THIS RUN (0-80 CHAR)	CURRENTLY
04/03/83 16.58.48.	
HEAT - IF HEAT CALCULATIONS ARE REQUIRED	NOT INCLUDED
GEOM - FOR THE GEOMETRY	SLAB GEOMETRY
LHB - LEFT HAND BOUNDARY CONDITIONS	A CONTINUUM
RHB - RIGHT HAND BOUNDARY CONDITIONS	A CONTINUUM
CONT - TO CONTINUE	

:tit

ENTER A TITLE FOR THIS RUN :
:cylinder test comp b steel 4.225, 5.225 cm dimensions

ENTER ONE OF THE FOLLOWING

DEFAULT

TITLE - FOR THE TITLE OF THIS RUN (0-80 CHAR)	CURRENTLY
CYLINDER TEST COMP B STEEL 4.225, 5.225 CM DIMENSIONS	
HEAT - IF HEAT CALCULATIONS ARE REQUIRED	NOT INCLUDED
GEOM - FOR THE GEOMETRY	SLAB GEOMETRY
LHB - LEFT HAND BOUNDARY CONDITIONS	A CONTINUUM
RHB - RIGHT HAND BOUNDARY CONDITIONS	A CONTINUUM
CONT - TO CONTINUE	

:geo

ENTER GEOMETRY

SLAB - FOR SLAB GEOMETRY
CYLIND - FOR CYLINDRICAL GEOMETRY
SPHER - FOR SPHERICAL GEOMETRY

:cyl

ENTER ONE OF THE FOLLOWING

DEFAULT

TITLE - FOR THE TITLE OF THIS RUN (0-80 CHAR)	CURRENTLY
CYLINDER TEST COMP B STEEL 4.225, 5.225 CM DIMENSIONS	
HEAT - IF HEAT CALCULATIONS ARE REQUIRED	NOT INCLUDED
GEOM - FOR THE GEOMETRY	CYLINDRICAL GEOMETRY
LHB - LEFT HAND BOUNDARY CONDITIONS	A CONTINUUM
RHB - RIGHT HAND BOUNDARY CONDITIONS	A CONTINUUM
CONT - TO CONTINUE	

:cont

OUTPUT MENU

ENTER ONE OF THE FOLLOWING

DEFAULT

PRINT - CYCLES PRINTED	400
GRAPH - CYCLES GRAPHED	.400E+03
DUMP - CYCLES DUMPED	.200E+07
IPR - FOR A PLOT OF PRESS VS RADIUS	
ITR - FOR A PLOT OF TEMP VS RADIUS	
IWR - FOR A PLOT OF MASS FRAC VS RADIUS	
IIR - FOR A PLOT OF VOLUME VS RADIUS	
IUR - FOR A PLOT OF PART VEL VS RADIUS	
CONT - TO CONTINUE	NO GRAPHICAL OUTPUT REQUESTED

:print

ENTER N, WHERE EVERY N CYCLES ARE PRINTED
:100

OUTPUT MENU

ENTER ONE OF THE FOLLOWING

DEFAULT

PRINT - CYCLES PRINTED	100
GRAPH - CYCLES GRAPHED	.400E+03
DUMP - CYCLES DUMPED	.200E+07
IPR - FOR A PLOT OF PRESS VS RADIUS	
ITR - FOR A PLOT OF TEMP VS RADIUS	
IWR - FOR A PLOT OF MASS FRAC VS RADIUS	
IIR - FOR A PLOT OF VOLUME VS RADIUS	
IUR - FOR A PLOT OF PART VEL VS RADIUS	
NO GRAPHICAL OUTPUT REQUESTED	
CONT - TO CONTINUE	

:iur

OUTPUT MENU

ENTER ONE OF THE FOLLOWING

DEFAULT

PRINT - CYCLES PRINTED	100
GRAPH - CYCLES GRAPHED	.400E+03
DUMP - CYCLES DUMPED	.200E+07
IPR - FOR A PLOT OF PRESS VS RADIUS	
ITR - FOR A PLOT OF TEMP VS RADIUS	
IWR - FOR A PLOT OF MASS FRAC VS RADIUS	
IIR - FOR A PLOT OF VOLUME VS RADIUS	
IUR - FOR A PLOT OF PART VEL VS RADIUS	
A GRAPH OF PART VEL VS RADIUS WILL BE PLOTTED EVERY .400E+03 CYCLES	
CONT - TO CONTINUE	

:cont

ENTER THE NAME OF COMPONENT 1, OR A QUESTION MARK '?' FOR A LIST
OF THE COMPONENTS ON FILE
:?

THE COMPONENTS ON FILE ARE :-

COMPONENTS ON FILE

COMMENT

STEEL	PETERS PROBLEM RDX FILLED
RDX	PETERS PROBLEM RDX FILLED
TNT	INITIATION OF TNT (WATER ONLY)
H6	MARK 82 H6 FULL SIZE
COMP B	4.5 INCH SHELL/BARREL/JACKET
AIR	
PETN	DAVID'S PROB
POLYETHYLENE	DAV'S
WATER	DAV'S
PETN(RHO=1.4	DAV'S
PENTOLITE	DAV'S

THERE ARE 11 COMPONENTS ON THE COMPONENTS FILE

ENTER THE NAME OF COMPONENT 1
:comp b

COMP B HAS BEEN FOUND ON THE COMPONENTS FILE

ENTER THE NUMBER OF SPACE INCREMENTS FOR COMP B
:50

ENTER THE SPACE INCREMENT SIZE FOR COMP B [CM]
:0.0845

A GOOD APPROXIMATION OF THE TIME INCREMENT IS 0.2 OF THE CELL WIDTH
WHICH IN THIS CASE IS .1690000E-01 IS THIS APPROXIMATION
VALID [Y/N]
:y

PLEASE ENTER ONE OF THE FOLLOWING

	<u>DEFAULT</u>
VISC - FOR THE VISCOSITY FACTOR	2.00
BURN - FOR TYPE OF BURN	ARRHENIUS BURN
FORM - FOR TYPE OF VISCOSITY	PIC VISCOSITY
PRES - INITIAL PRESSURE	.100E-05 MBAR
TEMP - INITIAL TEMPERATURE	.300E+03 K
ENGY - INITIAL INTERNAL ENERGY	0. MBAR-CC/G
VELC - INITIAL VELOCITY	0. CM/MICROSEC
FREQ - FREQUENCY FACTOR	.100E+16
ACTV - ACTIVATION ENERGY	.450E+05
NUMB - NUMBER OF CELLS	50
SIZE - SIZE OF THE CELLS	.845E-01 CM
TIME - TIME INCREMENTS	.169E-01 MICROSEC
MASS - MASS FRACTION	0. G
DENS - DENSITY	.165E+01 G/CC
PAR - PARAMETERS RELATING TO THE EQU OF STATE	
CONT - TO CONTINUE	

:cont

ARE THERE ANY MORE COMPONENTS ? [Y/N]
:y

ENTER THE NAME OF COMPONENT 2, OR A QUESTION MARK '?' FOR A LIST
OF THE COMPONENTS ON FILE
:steel

STEEL HAS BEEN FOUND ON THE COMPONENTS FILE

ENTER THE NUMBER OF SPACE INCREMENTS FOR STEEL
:40

ENTER THE SPACE INCREMENT SIZE FOR STEEL [CM]
:0.025

A GOOD APPROXIMATION OF THE TIME INCREMENT IS 0.2 OF THE CELL WIDTH
WHICH IN THIS CASE IS .5000000E-02 IS THIS APPROXIMATION
VALID [Y/N]
:y

PLEASE ENTER ONE OF THE FOLLOWING

	<u>DEFAULT</u>
VISC - FOR THE VISCOSITY FACTOR	2.00
FORM - FOR TYPE OF VISCOSITY	PIC VISCOSITY
PRES - INITIAL PRESSURE	.100E-05 MBAR
TEMP - INITIAL TEMPERATURE	.300E+03 K
ENGY - INITIAL INTERNAL ENERGY	0. MBAR-CC/G
VELC - INITIAL VELOCITY	0. CM/MICROSEC
NUMB - NUMBER OF CELLS	40
SIZE - SIZE OF THE CELLS	.250E-01 CM
TIME - TIME INCREMENTS	.500E-02 MICROSEC
MASS - MASS FRACTION	.100E+01 G
DENS - DENSITY	.792E+01 G/CC
PAR - PARAMETERS RELATING TO THE EQU OF STATE	
CONT - TO CONTINUE	

:cont

ARE THERE ANY MORE COMPONENTS ? [Y/N]
:y

ENTER THE NAME OF COMPONENT 3, OR A QUESTION MARK '?' FOR A LIST
OF THE COMPONENTS ON FILE
:air

AIR HAS BEEN FOUND ON THE COMPONENTS FILE

ENTER THE NUMBER OF SPACE INCREMENTS FOR AIR
:10

ENTER THE SPACE INCREMENT SIZE FOR AIR [CM]
:1.0

A GOOD APPROXIMATION OF THE TIME INCREMENT IS 0.2 OF THE CELL WIDTH
WHICH IN THIS CASE IS .2000000E+00 IS THIS APPROXIMATION
VALID [Y/N]
:y

PLEASE ENTER ONE OF THE FOLLOWING

DEFAULT

VISC - FOR THE VISCOSITY FACTOR	2.00
BURN - FOR TYPE OF BURN	ARRHENIUS BURN
FORM - FOR TYPE OF VISCOSITY	PIC VISCOSITY
PRES - INITIAL PRESSURE	.100E-05 MBAR
TEMP - INITIAL TEMPERATURE	.300E+03 K
ENGY - INITIAL INTERNAL ENERGY	0. MBAR-CC/G
VELC - INITIAL VELOCITY	0. CM/MICROSEC
FREQ - FREQUENCY FACTOR	0.
ACTV - ACTIVATION ENERGY	0.
NUMB - NUMBER OF CELLS	10
SIZE - SIZE OF THE CELLS	.100E+01 CM
TIME - TIME INCREMENTS	.200E+00 MICROSEC
MASS - MASS FRACTION	.100E+01 G
DENS - DENSITY	.129E-02 G/CC
PAR - PARAMETERS RELATING TO THE EQU OF STATE	
CONT - TO CONTINUE	

:cont

ARE THERE ANY MORE COMPONENTS ? [Y/N]

:n

DO YOU WISH TO PLACE ANY OF THE COMPONENTS ON THE FILE [Y/N]

:

REPLY SHOULD BE 'Y' OR 'N' ## TRY AGAIN:

:n

THERE ARE 3 COMPONENTS INCLUDED IN RUN

CYLINDER TEST COMP B STEEL 4.255, 5.225 CM DIMENSIONS
AND THEY COMPRISE OF :

COMPONENTS

COMP B
STEEL
AIR

ENTER ONE OF THE FOLLOWING

CREAT - TO CREATE THE DATE FILE FOR 'SIN'
DEL - TO DELETE A COMPONENT FROM THE ABOVE
CONT - TO CONTINUE IE. ADD MORE COMPONENTS
ALT - TO ALTER ANY OF THE ABOVE COMPONENTS
START - TO START FROM SCRATCH AGAIN
EXIT - TO EXIT THE PROGRAM

:creat

THE DATA FILE 'SINDATA' HAS BEEN CREATED

ENTER ONE OF THE FOLLOWING

CREAT - TO CREATE THE DATE FILE FOR 'SIN'
DEL - TO DELETE A COMPONENT FROM THE ABOVE
CONT - TO CONTINUE IE. ADD MORE COMPONENTS
ALT - TO ALTER ANY OF THE ABOVE COMPONENTS
START - TO START FROM SCRATCH AGAIN
EXIT - TO EXIT THE PROGRAM

:exit

THE DATA FOR 'SIN' HAS BEEN PRODUCED AND IS IN YOUR DEFAULT ED LIB
'SINDATA'
7000 job existing
CIO active mode
:q,ed
ED version 15/10/82

SIN(T400)
 GETSET(DFC4522)
 PURGE(SINRUN,SN=DFC4522,ID=DFCEDN)
 EXIT(U)
 REQUEST(TAPE2,*PF,SN=DFC4522
 ATTACH(SINBIN,SINBIN,SN=DFC4522,ID=DFCEDN)
 SINBIN.
 EXIT(U)
 REWIND(TAPE2)
 CATALOG(TAPE2,SINRUN,SN=DFC4522,ID=DFCEDIN)
 *EOS

3 100 0 0 0 0 0 1 0 0 0 0
 CYLINDER TEST COMP B STEEL 4.225, 5.225 CM DIMENSIONS
 .20000000000E+01 .10000000000E+03 .40000000000E+03 .20000000000E+07

COMP B
 50 1 0 0
 .84500000000E-01 .16900000000E-01 .20000000000E+01 .16500000000E+01
 .10000000000E-05 .30000000000E+03 0. 0.
 .23100000000E+00 .18300000000E+01 .10000000000E-01 0.
 0. -.86482267660E+01 -.76497948971E+02 -.14330798590E+03
 -.12260697623E+03 -.34139045850E+02 .26600000000E+01 .25300000000E+00
 .60606060606E+00 .50000000000E-04 0. 0.
 .30000000000E+03 .10000000000E-05 0. 0.
 0. 0. 0.
 0. .10000000000E+16 .45000000000E+05 0.
 -.35222141110E+01 -.24959474720E+01 .25411585450E+00 .25589619270E-01
 -.10990541300E-01 -.15437672010E+01 .51978884760E+00 .79918603550E-01
 .65029983420E-02 .21499074120E-03 .75567098200E+01 -.45930275520E+00
 .66679250240E-01 .18767838090E-01 -.13302603210E-02 .50000000000E+00
 .10000000000E+00

STEEL
 40 0 0 0
 .25000000000E-01 .50000000000E-02 .20000000000E+01 .79170000000E+01
 .10000000000E-05 .30000000000E+03 0. 0.
 .45800000000E+00 .15100000000E+01 .10000000000E-01 0.
 0. -.38238258745E+04 -.70321195402E+04 -.48367021389E+04
 -.14667840212E+-4 -.16639161598E+03 .20000000000E+01 .10780000000E+00
 .12631047114E+00 .11700000000E-04 .70000000000E-01 .15000000000E+00
 .30000000000E+03 .10000000000E-05 .50000000000E-02 .97800000000E+00
 .50000000000E-01 .10000000000E-05 0.
 .10000000000E+01 0. 0. 0.

AIR
 10 1 0 0
 .10000000000E+01 .20000000000E+00 .20000000000E+01 .12929000000E-02
 .10000000000E-05 .30000000000E+03 0. 0.
 .33200000000E-01 .10461000000E+01 .10000000000E-01 0.
 0. .57030000000E+01 0. 0.
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